

# Waves

[https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string\\_en.html](https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html)



[https://phet.colorado.edu/sims/html/pendulum-lab/latest/pendulum-lab\\_en.html](https://phet.colorado.edu/sims/html/pendulum-lab/latest/pendulum-lab_en.html)



## Reference material:

### Chapter 10.4 (pg 248) of JMH Physics

### Chapter 8 of MHR

⇒ A wave is a transfer of energy, in a form of a disturbance usually through a material substance, or medium.

⇒ Electromagnetic Waves

⇒ Sound waves

⇒ Water waves

⇒ Pressure waves

⇒ Gravity waves

⇒ Matter waves

⇒ When objects repeat a pattern of motion (e.g. a pendulum), we say that object is vibrating or oscillating.

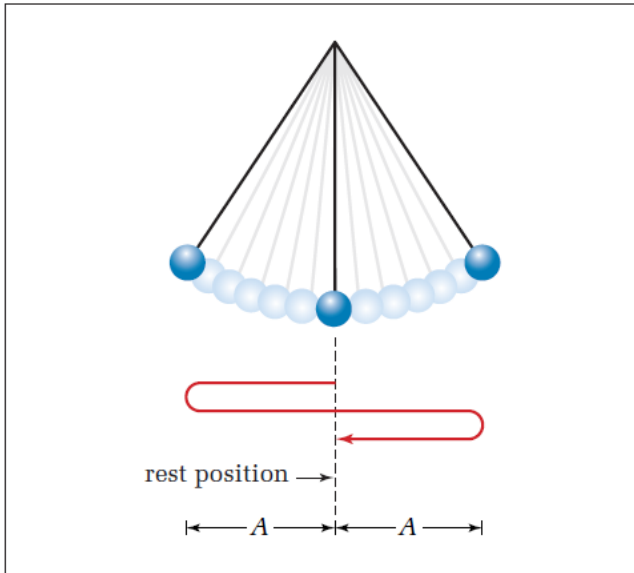
⇒ The oscillation is repeated over and over with the same time interval each time.

⇒ One complete oscillation is called a cycle.

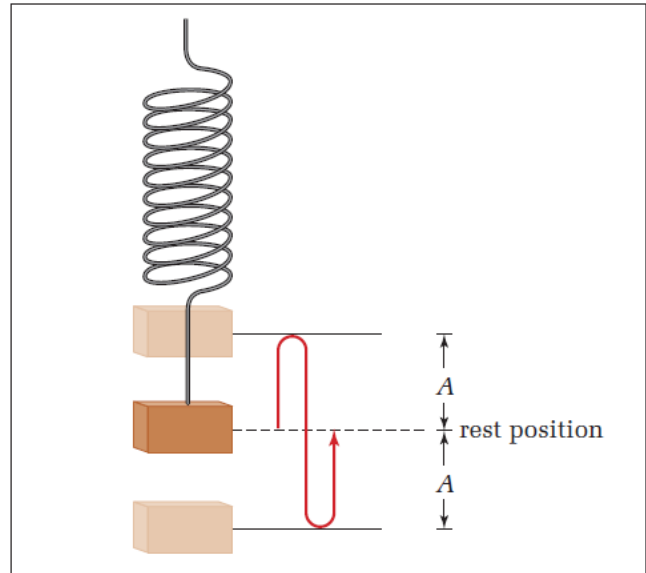
⇒ The number of cycles per second is called the frequency,  $f$ . The frequency is measured in Hertz (Hz).

⇒ The period,  $T$ , usually measured in seconds, is the time required for one cycle. The frequency and period are reciprocals of each other.

Close Read Pg 338 - 339 of MHR. Pay attention to and note the many terms introduced.



**Figure 8.2** (A) When a simple pendulum completes one full cycle of its motion, it is in its original position.



(B) One full cycle of the motion of the mass on a spring brings the mass back to the rest position.

### PERIOD AND FREQUENCY

The period is the quotient of the time interval and the number of cycles.

$$T = \frac{\Delta t}{N}$$

The frequency is the quotient of the number of cycles and the time interval.

$$f = \frac{N}{\Delta t}$$

The frequency is the reciprocal, or inverse, of the period.

$$f = \frac{1}{T}$$

Quantity	Symbol	SI unit
period	$T$	s (seconds)
frequency	$f$	Hz (hertz)
time interval	$\Delta t$	s (seconds)
number of cycles	$N$	none (pure number)

**Note:**  $1 \text{ Hz} = \frac{1}{\text{s}} = 1 \text{ s}^{-1}$

Example. A pendulum completes 30 cycles in 15 seconds. Calculate its frequency and period.

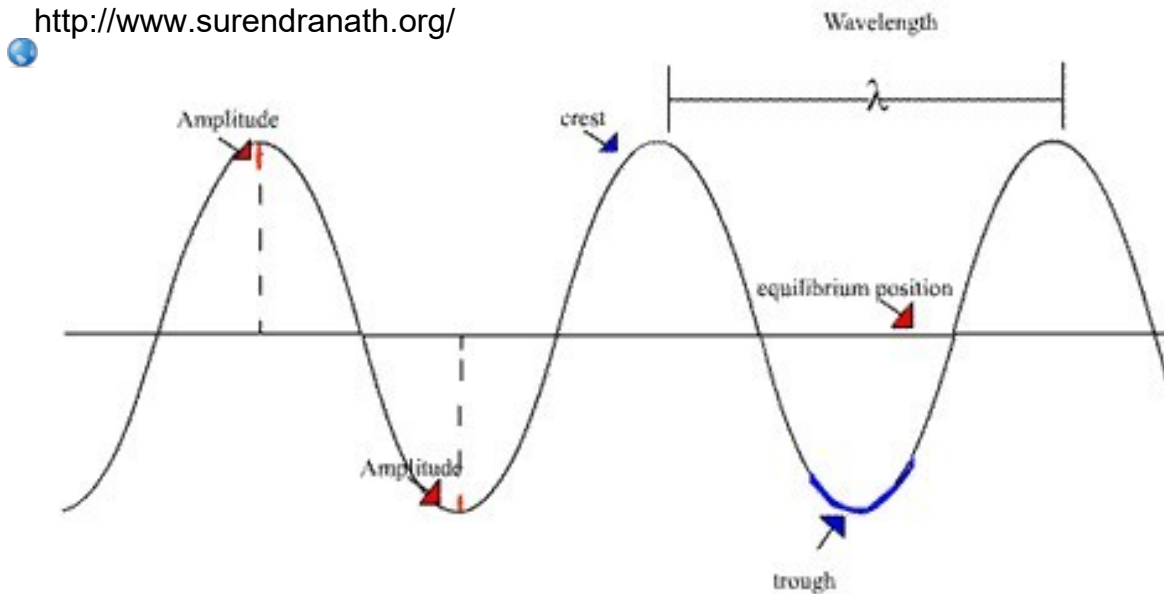
## Read MHR pg 344 - top of 345.

### Follow Up Questions:

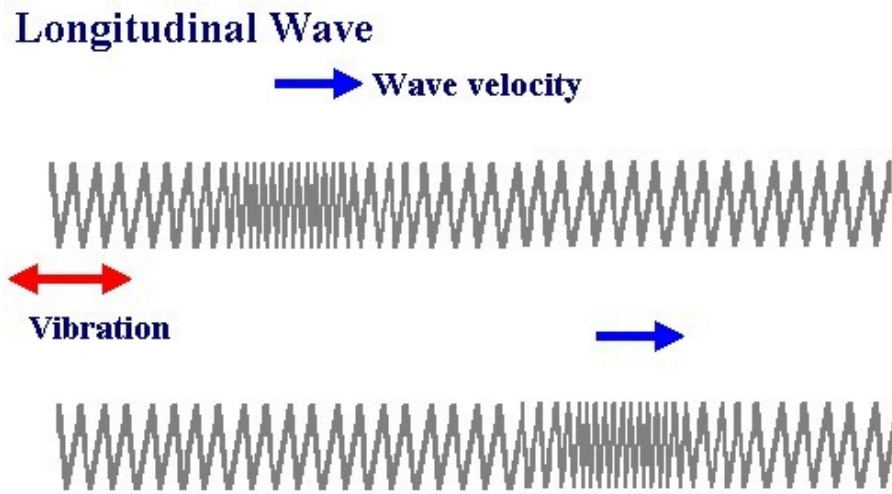
1. What is a medium when talking about waves?
2. Summarize the properties of mechanical waves.
3. What determines the speed of a mechanical wave?  
Provide an explanation for your answer.
4. What affect does friction have within a mechanical wave?

# Transverse Waves

<http://www.surendranath.org/>



- ⇒ The particles in the medium vibrate at right angles to the direction in which the wave travels.
- ⇒ The high section is called the crest, and the low section is called the trough.
- ⇒ The height of the crest or depth of the trough, from the equilibrium position is called the amplitude.
- ⇒ For periodic waves, the distance between successive crests and troughs is equal and is called the wavelength. The symbol for the wavelength is the Greek letter lambda,  $\lambda$
- ⇒ The period of a transverse wave is the time it takes for one wavelength (one cycle) to pass a fixed point.
- ⇒ The frequency is the number of wavelengths that passed a fixed point in one second.
- ⇒ Examples include water waves and making vibrations on a rope.



## Longitudinal Waves

- ⇒ The vibrations of the particles are parallel to the direction of motion.
- ⇒ There are a compressions and rarefactions created in longitudinal waves.
- ⇒ One wavelength is the distance between the midpoints of successive compressions or rarefactions.
- ⇒ The amplitude is the maximum displacement of the particles from their rest position. Amplitude is a measure of the wave's energy.
- ⇒ Sound waves, pressure waves are examples.